

Anti-smoking parenting practices: recall by and effect on children's risk of smoking after 3 years

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Received: 17 February 2010 / Revised: 23 September 2010 / Accepted: 25 November 2010 / Published online: 18 December 2010
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Abstract

Objectives Parent engagement in anti-smoking parenting practices was examined as a predictor of children's recalled exposure to these practices, the presence of pro-smoking risk factors in children's social environments, and children's odds of initiating smoking.

Methods 1,032 parents reported level of engagement in a program that promoted anti-smoking parenting practices for 8-year-old children. 1,032 children were surveyed 6 months and 3 years post-intervention; they reported on exposure to anti-smoking parenting practices, pro-smoking risk factors, and initiation of smoking.

Results If parents reported high engagement in anti-smoking socialization, children had significantly greater recall of anti-smoking parenting practices and significantly fewer pro-smoking risk factors up to 3 years post-intervention. If engagement was moderate or low, children had progressively lower odds of recalling anti-smoking parenting practices relative to controls and they were progressively less likely to differ from controls in exposure to pro-smoking risk factors at follow-up.

Conclusions Achieving full program implementation remains a significant challenge to home-based, parent-led approaches to smoking prevention. However, if parents fully engage in anti-smoking parenting practices, children demonstrate protective effects up to 3 years later.

Keywords Child · Smoking · Initiation · Prevention · Socialization · Parenting

Introduction

Darling and Steinberg's (1993) comprehensive model of parenting posits that "openness to parental influence" is a primary explanatory factor in predicting children's behavioral outcomes. This construct is conceptually analogous to Baumrind's (1978) earlier concept of "perceived legitimacy of parental authority." Both factors underscore the reciprocal nature of effective parenting: children's receptivity to parental influence is a key determinant of parents' capacity to influence children's behaviors.

As children mature, their receptivity to parental influence becomes increasingly differentiated. For example, children generally remain receptive to parental influence regarding conventional issues (e.g., education) but become less receptive to parental attempts to influence contemporary issues (e.g., clothing choices) (Smetana 1995; Smetana and Asquith 1994). In a previous study (Jackson 2002), we examined young adolescents' receptivity to parental authority regarding cigarette smoking and found that across gender, ethnicity and grade subgroups, 80% of early adolescents believed that their parents should have a say about whether or not they smoke cigarettes. This level of affirmation was significantly greater than that associated with contemporary issues—only 19 and 26% of adolescents believed that parents should have a say regarding their choices in music and clothing, respectively, or regarding conventional issues—68 and 55% of youth affirmed parental authority regarding education and religion, respectively.

Even if most children are open to parental influence attempts specific to cigarette smoking, do they actually retain memory of parents' efforts to socialize them against smoking? Long-term retention of parents' anti-smoking influence attempts is vital as children mature and have

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increased opportunities to initiate smoking. Parents' anti-smoking attitude, advice and sanctions must be cognitively accessible to children in order to have any protective effect on children's risk of smoking.

Using a prospective design, this study tested whether parental engagement in a program that recommended specific anti-smoking parenting practices predicted children's recalled exposure to these practices after 6 months and after 3 years. In addition, this study tested whether parental engagement in anti-smoking parenting practices predicted pro-smoking risk factors in children's social environments (e.g., having a best friend who has smoked) and their odds of initiating smoking after 3 years.

There are theoretical and practical reasons for studying children's recall of and responses to anti-smoking influence attempts by parents. Theories of child socialization (Maccoby 1992; Maccoby and Martin 1983) indicate that socialization may be a viable approach to reducing children's risk of initiating cigarette smoking. Briefly, socialization is the process through which children learn and internalize the normative beliefs, values, and behaviors important to members of their social groups. Socialization is a powerful determinant of behavior because a strong desire for approval by social groups drives compliance with group norms, and because individuals tend to avoid acting in ways that are inconsistent with internalized norms (Hare 1976; Janowitz 1975). Research on socialization indicates that parents are the primary socializing agents during the childhood years, and that, siblings, peers, teachers, and environmental factors, such as mass media, are important but secondary socializing agents (Maccoby 1992). In this regard, socialization theory provides a theoretical foundation for using parenting programs as a public health strategy for smoking prevention. An explicit test of children's long-term recall of and responses to anti-smoking parenting practices would provide empirical support for this application of theory to public health practice.

Assessing children's recall of and responses to anti-smoking parenting practices is also relevant to successful dissemination of parenting programs for smoking prevention. If it can be demonstrated that anti-smoking parenting practices have a sustained effect on children's smoking-specific socialization, then health educators, pediatricians and other anti-smoking advocates have information that can be used to boost parental motivation to adopt these practices. Parents' time is the most valuable asset for effective delivery of home-based child health promotion programs, and research evidence indicating that there is potential for influence will enable practitioners to justify the time parents would need to invest to engage in anti-smoking parenting practices.

Method

Recruitment method and study sample

Administrators of 14 North Carolina school districts allowed project staff to request that school principals disseminate recruitment materials that were approved by the Institutional Review Board at RTI International. Materials (consent form and intake screener) were mailed to elementary school principals with a cover letter that documented district cooperation. Principals were asked to distribute the materials to third grade teachers with the request that they send the materials home with students. Parents could enroll by mailing a signed consent form to a project office. The role of school districts was limited to dissemination of recruitment materials.

The study aimed to enroll parents or other legal guardians who were nonsmokers and who had a child enrolled in the third grade who had never tried smoking. The eligibility of consented parents and children was verified using baseline surveys, prior to enrollment and randomization. A total of 1,183 parents and children met these criteria, provided complete baseline data and were randomized to a study group ($n = 595$ program; $n = 588$ control). Preliminary analyses showed that there were no differences in the demographic profiles of these groups at baseline. Of these 1,183 parents and children, 1,032 (87%) were retained through the 3-year post-intervention follow-up survey with children and thereby provided data for the present analysis.

Engagement in anti-smoking parenting program

Printed materials in the form of activity magazines were mailed to the homes of parents in the program group monthly, for 5 months. The eight-step process used to develop these program materials has been described in detail in a previous publication (Jackson and Dickinson 2009). Briefly, by using parenting theory to inform practice, relying on the research literature to specify program objectives, engaging members of the target audience in intervention content development, and allocating resources to enhance the visual and production qualities of intervention materials, the program materials were designed to optimize the appeal, perceived relevance, usability, and ultimately, utilization, of the intervention. These materials provided detailed instructions and any support materials (e.g., tip sheets, worksheets, game pieces) needed to engage parents in highly structured anti-smoking socialization practices with their children (Jackson and Dickinson 2009). These practices included explaining the chemicals in tobacco and the nature of addiction to nicotine, strengthening children's media literacy skills specific to

portrayals of tobacco use and advertising of tobacco products, monitoring for peer smoking initiation or experimentation, teaching children peer pressure refusal skills specific to smoking initiation, and conveying to children the disciplinary consequences of trying smoking and the positive social consequences of remaining smoke-free.

Comparisons of study groups based on the intent-to-treat model revealed that there were no significant differences in smoking-specific outcomes between children in treatment versus control families (unpublished results). Additional analysis indicated that there was substantial variation in parental engagement in the program. Specifically, of the 524 parents assigned to the treatment group, 45.6% ($n = 238$) reported completing all or nearly all of the program components, 28.4% ($n = 149$) reported completing many but not all of the program components, and 26% ($n = 137$) reported that they completed only some of the program components. It is likely that this relatively low level of full treatment exposure was a primary reason for the null effects observed in the analyses based on the intent-to-treat model. To learn from the implementation of this program, this paper presents post hoc analyses based on an alternative, efficacy-based model of program evaluation. Efficacy research tests programs under optimal conditions, when program availability and acceptance are maximized (vs. effectiveness research, which tests programs under real-world field conditions, when program availability and acceptance vary) (Flay 1986). The efficacy model of program evaluation was applied in the present study by testing variation in parental program engagement (low, moderate, high) as a predictor of children's smoking-specific outcomes.

Families in the control group received no materials that described the specific anti-smoking parenting practices recommended to treatment-group parents. Instead, they received simple fact sheets with information about macro-level policy issues relevant to youth smoking (e.g., legislation to increase the cost of cigarettes or prohibit sales of tobacco to minors). Given no opportunity to view or utilize materials that provided instructions for the recommended anti-smoking parenting practices, families that had been assigned to the control group were included as a fourth, no engagement comparison group in the present study.

These four groups (high, moderate and low engagement and controls) were compared as follows: Variation in parental engagement in anti-smoking parenting practices while children were in third grade was used to predict children's recalled exposure to these practices after 6 months and after 3 years, to predict the number of pro-smoking risk factors in children's social environments after 3 years, and to predict children's odds of initiating smoking after 3 years.

Measures

Eligibility status at baseline

Parents were counted as eligible nonsmokers if, at baseline (prior to full enrollment in the study), they reported having never smoked cigarettes or having been a former smoker whose quitting date was at least 3 years prior to baseline. Children were counted as eligible never smokers if, at the same time point, they reported having never puffed a cigarette. This widely used measure of child initiation of smoking was selected based on a reliability study of elementary school children's self-reported initiation of smoking (Henriksen and Jackson 1999). Children's overtime consistency was evaluated by looking for logic errors between baseline and 1 year follow-up. Nearly all children (98%) provided reliable reports of "ever smoking, even one puff" over 1 year. These and other analyses reported in this study (Henriksen and Jackson 1999) corroborate the results of another reliability study (Brener et al. 1995) which found that youth are highly consistent over time in their reporting of initial smoking behavior.

Children's recalled exposure to anti-smoking parenting practices

Children completed telephone interviews 6 and 36 months after the final program magazine (or fact sheet for controls) were delivered during the intervention period (equivalently, 12 and 42 months post-baseline). Children reported having ever been exposed to 14 parenting practices that were targeted by the program; each exposure variable was coded 0 or 1.

Children's reports of pro-smoking influences in their social environment

A four-item summary scale was used to indicate the degree of pro-smoking influence evident in children's social environment after 3 years. These items, scored 0 or 1 were having a best friend who has tried smoking, perceiving easy access to cigarettes, believing that parents would not know if the child tried smoking, and believing that there would not be negative consequences if parents knew that the child had tried smoking.

Children's reports of having tried smoking

Also after 3 years, children responded to the question "Have you ever puffed on a cigarette, even one time?" As noted previously, children provide reliable reports within time and over time of dichotomous events like having ever puffed on a cigarette.

Covariates

Attributes of the child and attributes of the adult who enrolled with the child were measured: child's sex, whether child lived in one household or two, relation of the adult to the child (the category "mothers" included biological mothers, step-mothers, and other female guardians; likewise for "fathers"), adult's education (\leq high school, some college, college graduate), adult's race/ethnicity (white, nonwhite, other).

Survey procedure

Telephone interview data were obtained from parents and children. In the baseline year, during which both parties were interviewed, children were interviewed before parents to avoid the possibility that the parent interview would influence parental behavior about smoking and thereby influence children's responses. In all instances, interviewers were blinded to study condition.

Child interview

At baseline and 6 and 36 months post-intervention, the children's interview was administered by trained interviewers who had at least 2 years of experience working with children and successfully completed 30 h of training over a 2-week period. Each child interview began by asking parents to provide verbal consent before interviewers spoke with children (this was in addition to signed consent already on file). A key feature of the child interview method was that the questions were structured so that response choices would not convey any potentially sensitive information. For example, items asked children to say aloud only uninformative responses (e.g., "agree" or "never"). This telephone interview method has been used by our project team in other studies of children who were age 7–9 at baseline; nearly all of these children understood and were competent to follow this protocol. Although completion times varied, the interview proper took about 25–30 min to complete.

Parent interview

The parent interview followed a standard adult telephone interview protocol. A consent transcript was read that repeated information from the written consent form pertaining to confidentiality, skipping questions, the interview fee (\$20), and stopping the interview. Parents' interviews required about 25 min to complete.

Analyses

For attrition analysis, Chi-square tests were used to examine the demographic comparability of enrollees retained over

3 years ($n = 1,032$) with enrollees who completed the baseline assessment but were lost to follow-up ($n = 151$). Chi-square tests were also used to assess the demographic comparability of the four study groups.

Hierarchical logistic regression analyses were used to test whether parent reports of program engagement predicted children's recalled exposure to anti-smoking parenting practices after 6 months and after 3 years. Each exposure variable was regressed at step one on the covariates and at step two on a categorical indicator of parental engagement. With control group families designated as the referent group, the resulting odds ratios indicate the odds of children's recalled exposure at each level of parental engagement. Analysis of variance was used to test for an association between level of parental engagement and children's reports of pro-smoking influences in their social environment after 3 years. Logistic regression analysis was used to test whether level of parental engagement predicted child initiation of smoking after 3 years.

Results

Comparisons between participants retained over 3 years ($n = 1,032$) and those lost to follow-up ($n = 151$) showed that differential attrition occurred within subgroups defined by parent relation to child (8.2% of parents lost to follow-up were fathers vs. 6.1% of those retained), parent race/ethnicity (37.3% of parents lost to follow-up were black vs. 22.2% of those retained) and parent education (28% of parents lost to follow-up had a high school education or less vs. 16% of those retained). The observed differential attrition reduces somewhat the external validity of the study results.

Comparisons between the four groups defined by parental engagement in the targeted anti-smoking socialization practices are shown in Table 1. As indicated there, although the distributions by child sex, number of households, parent relation to child, parent education, and parent race/ethnicity varied by level of parental program engagement, none of these differences was statistically significant. Nevertheless, some variation was evident and all of these demographic variables were used as covariates in the analyses.

The results for children's recalled exposure to anti-smoking parenting practices after 6 and 36 months are shown in Tables 2 and 3, respectively. After 6 months, children whose parents had reported a high level of anti-smoking socialization activity had significantly higher adjusted odds of recalling exposure to 13 of the 14 discrete parenting practices assessed (Table 2). Relative to controls, children with highly engaged parents were more than twice as likely to recall having been exposed to parenting

Table 1 Percent distribution of demographic variables across the four comparison groups, North Carolina, 2007

| | Control group <i>n</i> = 508 | Low engagement <i>n</i> = 137 | Moderate engagement <i>n</i> = 149 | High engagement <i>n</i> = 238 | χ^2 | <i>p</i> value |
|---------------------------|---------------------------------|----------------------------------|---------------------------------------|-----------------------------------|----------|----------------|
| Child sex | | | | | | |
| Female | 52.2 | 47.2 | 53.4 | 58.4 | 3.74 | 0.29 |
| Male | 47.8 | 52.8 | 46.6 | 41.6 | | |
| Child lives > 1 household | | | | | | |
| Yes | 9.1 | 8.6 | 13.0 | 15.1 | 6.34 | 0.09 |
| No | 90.9 | 91.4 | 87.0 | 84.9 | | |
| Parent relation to child | | | | | | |
| Father | 6.1 | 8.5 | 6.9 | 5.9 | 0.97 | 0.80 |
| Mother | 93.9 | 91.5 | 93.1 | 94.1 | | |
| Parent race/ethnicity | | | | | | |
| White | 70.5 | 71.4 | 82.8 | 75.4 | 10.81 | 0.09 |
| Black | 24.7 | 22.9 | 11.2 | 20.2 | | |
| Other | 4.8 | 5.7 | 6.0 | 4.4 | | |
| Parent education | | | | | | |
| ≤High school | 15.9 | 17.9 | 17.2 | 17.6 | 5.53 | 0.47 |
| Some college | 40.7 | 46.2 | 39.7 | 34.1 | | |
| BS or higher | 43.4 | 35.8 | 43.1 | 48.4 | | |

practices that aimed to teach smoking-specific media literacy skills, explain the chemical and addictive nature of tobacco products, convey parental anti-smoking attitude, and establish an anti-smoking social contract between parent and child. Children of highly engaged parents also were significantly more likely to recall exposure to parental monitoring of peer smoking, parental efforts to teach peer pressure refusal skills, and parental communication of the negative disciplinary consequences of trying smoking and the positive consequences of remaining abstinent.

Of the 14 practices targeted by the program, children whose parents had reported moderate program engagement were significantly more likely than controls to recall 7 of these practices (Table 2). Children whose parents reported a low level of program engagement were no different than controls in their odds of recalling exposure to anti-smoking parenting practices after 6 months. The overall pattern of results at 6 months indicated a dose–response pattern: children of low, moderate, and high engaged parents had progressively greater odds of recalling anti-smoking parenting practices relative to controls.

The second set of regression analyses tested whether parental program engagement had a sustained effect on children's recall of anti-smoking parenting practices after 3 years (Table 3). The results show that children whose parents reported a high level of engagement in anti-smoking socialization were significantly more likely than controls to recall exposure to 9 of the 14 targeted parenting practices after 3 years. The adjusted odds ratios in Table 3 indicate that, in general, the magnitude of the differences

between children of highly engaged parents and controls diminished between the 6-month assessment and the 3-year assessment. Overall, however, if parents had been highly engaged, their children were significantly more likely to recall known effective anti-smoking parenting practices, even after 3 years.

Children whose parents reported a moderate level of program engagement also showed diminished recall after 3 years. Whereas children in this group were significantly more likely than controls to report exposure to 7 of the 14 parenting practices at 6 months (Table 2), they reported greater exposure to only 2 of the 14 practices after 3 years (Table 3).

The next analysis tested whether parental program engagement predicted degree of pro-smoking influence in children's social environment (e.g., having a best friend who has tried smoking; perceiving easy access to cigarettes) after 3 years. The analysis of variance showed a significant overall effect of parental engagement on the degree of pro-smoking influence reported by children ($F = 4.19$; $p < 0.00$). A Bonferroni test identified significant differences in pro-smoking influence between the high engagement group and controls ($p < 0.05$); the difference between the moderate engagement group and controls approached significance ($p = 0.053$). There was no difference in the degree of pro-smoking social influences reported by children of low engaged parents versus controls.

The final analysis tested whether parental program engagement predicted children's odd of having ever puffed

Table 2 Level of parental engagement in anti-smoking parenting program and odds of child recall of anti-smoking parenting practices after six months, North Carolina, 2007

| Recalled parenting practices | Low engagement (<i>n</i> = 137) ^a | | | Moderate engagement (<i>n</i> = 149) | | | High engagement (<i>n</i> = 238) | | |
|--|---|-----------|----------------|---------------------------------------|-----------|----------|-----------------------------------|-----------|----------|
| | OR ^b | 95% CI | <i>p</i> | OR | 95% CI | <i>p</i> | OR | 95% CI | <i>p</i> |
| Strengthen child's media literacy skills | | | | | | | | | |
| Discuss smoking by actors, performers | 1.02 | 0.68–1.54 | 0.91 | 1.11 | 0.75–1.66 | 0.58 | 1.86 | 1.32–2.63 | 0.00 |
| Debunk tobacco print advertisements | 1.36 | 0.90–2.06 | 0.14 | 2.38 | 1.57–3.59 | 0.00 | 2.89 | 2.02–4.14 | 0.00 |
| Explain why people smoke | | | | | | | | | |
| Addictive chemicals in tobacco smoke | 1.23 | 0.81–1.85 | 0.33 | 1.30 | 0.87–1.94 | 0.19 | 2.09 | 1.47–2.98 | 0.00 |
| Nature of nicotine dependence | 1.14 | 0.73–1.77 | 0.05 | 1.61 | 1.02–2.54 | 0.03 | 2.03 | 1.36–3.04 | 0.00 |
| Convey anti-smoking position to child | | | | | | | | | |
| Make anti-smoking attitude explicit | 1.01 | 0.50–1.98 | 0.99 | 1.08 | 0.54–2.13 | 0.82 | 3.97 | 1.56–9.10 | 0.00 |
| Establish social contract against smoking | 1.04 | 0.72–1.67 | 0.88 | 1.88 | 1.19–2.95 | 0.00 | 2.12 | 1.45–3.12 | 0.00 |
| Monitor for peer smoking | | | | | | | | | |
| Ask child if peers have smoked | | | – ^c | | | – | | | – |
| Remind child to tell parent if peers smoke | 1.10 | 0.72–1.67 | 0.65 | 1.48 | 0.99–2.21 | 0.05 | 1.56 | 1.11–2.19 | 0.01 |
| Explain how tobacco affects the body | | | | | | | | | |
| How smoke affects physical abilities | 1.08 | 0.68–1.71 | 0.71 | 1.69 | 1.04–2.74 | 0.03 | 1.77 | 1.17–2.68 | 0.00 |
| How smoke affects appearance | 1.42 | 0.86–2.33 | 0.16 | 2.16 | 1.26–3.70 | 0.00 | 2.16 | 1.37–3.40 | 0.00 |
| Teach child behavioral risk reduction skills | | | | | | | | | |
| How to ask adults not to smoke near child | 1.06 | 0.70–1.61 | 0.76 | 1.39 | 0.91–2.12 | 0.35 | 1.93 | 1.35–2.75 | 0.00 |
| How to refuse peer influences to smoke | 0.85 | 0.55–1.31 | 0.46 | 1.60 | 1.02–2.57 | 0.04 | 1.80 | 1.21–2.71 | 0.00 |
| Convey consequences of trying smoking | | | | | | | | | |
| Disciplinary consequences of trying smoking | 1.07 | 0.71–1.63 | 0.73 | 1.52 | 0.99–2.35 | 0.05 | 1.96 | 1.34–2.86 | 0.00 |
| Positive consequences of staying smoke-free | 1.34 | 0.88–2.05 | 0.16 | 1.50 | 1.03–2.25 | 0.04 | 1.58 | 1.11–2.23 | 0.01 |

^a Control group (*n* = 508) was designated the referent category in the regression model

^b All odds ratios adjusted for child gender, child living in >1 household; parent relation with child, parent education, and parent race/ethnicity

^c The four-level engagement variable did not enter the regression model

on a cigarette after 3 years. In the multivariate regression model, after adjustment for the study covariates, the categorical indicator of parental engagement had no association with child initiation of smoking after 3 years.

Discussion

The majority of smoking prevention programs have been school-based and reach students in grades 6 or higher (Wiehe et al. 2005). This study examined the efficacy of an alternative approach; a home-based program reaching parents whose children were in grade 3 and involving parents in anti-smoking parenting practices. By providing parents with materials that gave detailed instructions for specific anti-smoking parenting practices, this program aimed to increase child exposure to such practices, reduce the likelihood of pro-smoking influences in children's social environment, and reduce the odds that children would initiate smoking.

The present efficacy-based evaluation, which tested variation in parental engagement in anti-smoking socialization as predictor of child outcomes, indicated that this

home-based approach achieved some of these specified aims. When parents reported high engagement, children had sustained recall of anti-smoking parenting practices, evident as long as 3 years post-intervention. Particularly enduring were children's recall of parenting practices that strengthened children's media literacy specific to marketing of tobacco products, monitored for smoking by peers, and conveyed the consequences of smoking behavior. Children of highly engaged parents were also significantly less likely than controls to report having pro-smoking influences in their social environment, including having a friend who has tried smoking, perceived lack of parental monitoring of child smoking, and perceived easy access to cigarettes. These are key determinants of children's lifetime odds of initiating cigarette smoking (DiClemente et al. 2001; Flay et al. 1998). Overall, high parental engagement in anti-smoking parenting practices led to important reductions in risk factors for the uptake of smoking by children.

Despite these promising findings, high program engagement was not associated with a reduced likelihood of smoking initiation after 3 years. It is possible that the

Table 3 Level of parental engagement in anti-smoking parenting program and odds of child recall of anti-smoking parenting practices after 3 years, North Carolina, 2007

| Recalled parenting practices | Low engagement (<i>n</i> = 137) ^a | | | Moderate engagement (<i>n</i> = 149) | | | High engagement (<i>n</i> = 238) | | |
|--|---|-----------|----------------|---------------------------------------|-----------|----------|-----------------------------------|-----------|----------|
| | OR ^b | 95% CI | <i>p</i> | OR | 95% CI | <i>p</i> | OR | 95% CI | <i>p</i> |
| Strengthen child's media literacy skills | | | | | | | | | |
| Discuss smoking by actors, performers | 1.21 | 0.79–1.86 | 0.38 | 1.17 | 0.77–1.76 | 0.45 | 2.32 | 1.58–3.41 | 0.00 |
| Debunk tobacco print advertisements | 1.35 | 0.76–2.07 | 0.16 | 1.42 | 0.99–2.04 | 0.05 | 1.69 | 1.09–2.63 | 0.02 |
| Explain why people smoke | | | | | | | | | |
| Addictive chemicals in tobacco smoke | 1.07 | 0.73–1.68 | 0.73 | 1.24 | 0.80–1.92 | 0.32 | 1.49 | 1.02–2.17 | 0.03 |
| Nature of nicotine dependence | | | – ^c | | | – | | | – |
| Convey anti-smoking position to child | | | | | | | | | |
| Make anti-smoking attitude explicit | | | – | | | – | | | – |
| Establish social contract against smoking | 1.01 | 0.49–2.07 | 0.99 | 1.16 | 0.61–2.76 | 0.64 | 2.76 | 1.75–4.35 | 0.00 |
| Monitor for peer smoking | | | | | | | | | |
| Ask child if peers have smoked | 0.98 | 0.48–2.01 | 0.95 | 1.37 | 0.97–1.93 | 0.07 | 1.45 | 0.99–2.18 | 0.07 |
| Remind child to tell parent if peers smoke | 1.25 | 0.81–1.94 | 0.30 | 1.40 | 0.94–2.10 | 0.10 | 1.76 | 1.24–2.49 | 0.00 |
| Explain how tobacco affects the body | | | | | | | | | |
| How smoke affects physical abilities | | | – | | | – | | | – |
| How smoke affects appearance | 1.22 | 0.83–1.82 | 0.32 | 1.65 | 0.90–3.02 | 0.10 | 2.11 | 1.22–3.65 | 0.01 |
| Teach child behavioral risk reduction skills | | | | | | | | | |
| How to ask adults not to smoke near child | 1.39 | 0.91–2.13 | 0.11 | 1.21 | 0.81–1.80 | 0.12 | 1.64 | 1.14–2.36 | 0.01 |
| How to refuse peer influences to smoke | | | – | | | – | | | – |
| Convey consequences of trying smoking | | | | | | | | | |
| Disciplinary consequences of trying smoking | 1.10 | 0.69–1.72 | 0.66 | 1.74 | 1.08–2.82 | 0.02 | 1.76 | 1.18–2.64 | 0.01 |
| Positive consequences of staying smoke-free | 1.01 | 0.65–1.57 | 0.95 | 1.58 | 1.04–2.40 | 0.02 | 1.88 | 1.32–2.67 | 0.00 |

^a Control group (*n* = 508) was designated the referent category in the regression model

^b All odds ratios adjusted for child gender, child living in >1 household; parent relation with child, parent education, and parent race/ethnicity

^c The four-level engagement variable did not enter the regression model

children in this study were, at the 3 year follow-up (when the mean age was 11.7 years) still too young to show a differentiated risk of smoking in response to parental engagement in anti-smoking parenting practices. Although, in past research, we have observed a difference in the risk of smoking between children exposed to different levels of anti-smoking parenting practices (Jackson and Dickinson 2006), these differences were observed among children whose parents were current smokers. Children of current smokers have a greater likelihood of early initiation of smoking relative to children of nonsmokers and hence, they are more likely than children of nonsmokers to be influenced by anti-smoking parenting practices at a young age. A longer follow-up period, spanning to age 14 (the peak age for initiation of smoking) could be required to detect differential risk of smoking among children of nonsmokers.

Among children whose parents reported moderate program engagement, the 6-month recall of exposure to anti-smoking parenting practices was generally greater than that of controls. However, children of moderately engaged parents had lower likelihood of recall than children of highly engaged parents, and their overall level of recall

approached the level of control group children by the 3 year follow-up. Children whose parents reported low engagement were, overall, no different from controls at either follow-up point.

Clearly, strong parental engagement in recommended anti-smoking parenting practices is a prerequisite if children are to experience any long-term benefits. There is need for research to understand what factors determine level of parental engagement and to apply this information to boost level of participation in home-based self-administered health education programs. Secondary analyses showed that there was no association between parental smoking history and level of engagement. Because this study did not collect data on reasons for parental engagement, we can only speculate that in addition to the normal time and convenience factors, it is possible that the parents who participated in the study found the program materials less relevant than expected and thereby elected not to fully engage in their use. A selection bias at recruitment might have produced a study sample that over-represented parents who were already strongly anti-smoking and were therefore not as in need of the program materials as parents

generally, who tend to be complacent about smoking prevention during children's elementary school years. This type of selection bias would reduce the perceived relevance of the program content for parents, and perceived relevance is a key determinant of engagement. This type of selection bias is an unfortunately common challenge in evaluations of health education programs: participation in such programs is always voluntary and it is often the case that those who would be most likely to benefit are among the least likely to volunteer to participate. Addressing this challenge calls for developing new mechanisms to boost recruitment of families at greatest risk. Strategies that merit investigation include collaborating with pediatricians willing to refer at risk families (i.e., families in which parents have not considered or engaged in anti-smoking socialization) and applying tailored recruitment messages that target segments of the parent population and aim to increase parental motivation to provide anti-smoking socialization at home.

Study limitations

The categorical indicator of program engagement used in this study did not provide component level data on program utilization. The study also did not assess parents' reasons for their level of program engagement. Hence, there could be unknown differences between the comparison groups that could account for the study findings.

It is possible that a selection bias was operating that resulted in a study sample of parents who were engaged in reducing their children's risk of smoking. This could have lowered parents' perceived need for implementing the program as recommended.

The duration of follow-up in this study, which included only children of nonsmokers, may have been insufficient to detect any long-term effects of high program engagement on children's initiation of smoking.

Conclusion

Achieving full program implementation remains a significant challenge to home-based, parent-led programs for child smoking prevention. However, when parents do fully engage in recommended anti-smoking parenting practices, children are likely to recall these efforts for at least 3 years. Moreover, exposure to a high dose of anti-smoking parenting practices can, even after 3 years, result in children being less likely to have a best friend who has tried smoking and less likely to perceive easy access to cigarettes, more likely to believe that parents would detect smoking, and more likely to expect negative consequences

for initiating smoking. Successful modification of these known risk factors for the uptake of smoking should, over the long term, have a protective effect on children's risk of smoking.

Acknowledgments This study was supported by grant funds from the National Cancer Institute (grant number RO1 CA106316).

Conflict of interest The authors declare that they have no competing interests.

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